Fermilab

CHANGE IN FIELD INTENSITY OF TEVATRON DIPOLES

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The integral field ($\int$Bdl) for Tevatron dipoles, as measured at MTF, shows a significant change between the first 200 series magnet and present magnets (see Fig. 1). The Tevatron Design Report gives the acceptance criterion for $\int$Bdl as ± 0.1% about the mean at 2KA. The previous acceptance criterion used was (122.1Ø ± 0.12) KG-M. Up until magnet 260 or so, essentially all magnets passed this criterion. Above magnet 270, almost all magnets fail the criterion. The $\int$Bdl for three magnets was remeasured in order to see if the observed increase in $\int$Bdl was due to a calibration change at MTF. The results from these remeasurements are as follows:

Magnet	$\int$Bdl/Date of 1st Measurement	$\int$Bdl/Date of Remeasurement
208	122.08/June '79	122.09/July '80
237	122.08/Sept.'79	122.13/July '80
239	122.20/Sept.'79	122.20/July '80

From the above table, it appears that there was no significant change in calibration for $\int$Bdl at MTF, and that the increase seen in Fig. 1 is real.

The average field intensity as measured with the NMR probe at MTF is plotted against magnet number in Fig. 2. (This average was obtained using all NMR measurements except those within 1 foot of the magnet ends.) The NMR data show the same trend as do the $\int$Bdl data. Figure 3 is a scatterplot of the $\int$Bdl data versus the NMR data. A constant slope for these data points

would imply that the increase in ∫Bdl comes only from the increase in field intensity and not from a change in magnet length. For comparison, the constant slope in Fig. 3 corresponds to a magnet length of 240 inches.

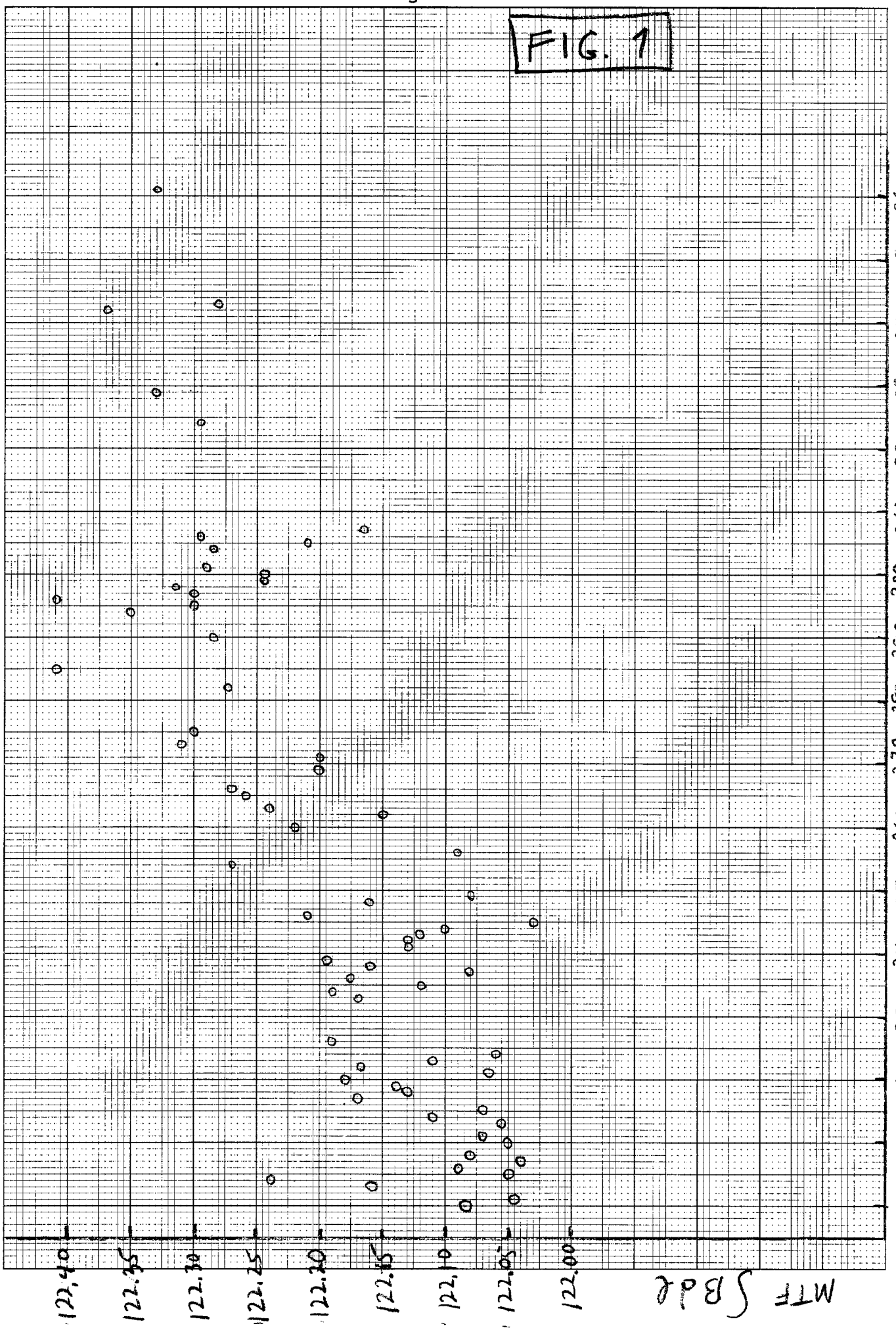
Figure 4 is a plot of the ∫Bdl versus magnet number obtained from the room temperature measurements; these data show the same behavior as the MTF ∫Bdl and the <NMR> data.

Conclusions:

The data presented here clearly show that the ∫Bdl and field intensity for Tevatron dipoles has changed significantly over the past year. The data are consistent with the ∫Bdl change being due to the field change. Figures 1, 2, and 4 seem to favor the interpretation that this change happened relatively suddenly between magnets 260 and 270 as opposed to a continuous change.

Studies to understand this problem are underway.

FIG. 1


MTF ∫Bdℓ
122.40
122.35
122.30
122.25
122.20
122.15
122.10
122.05
122.00
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
360
MAGNET NO.

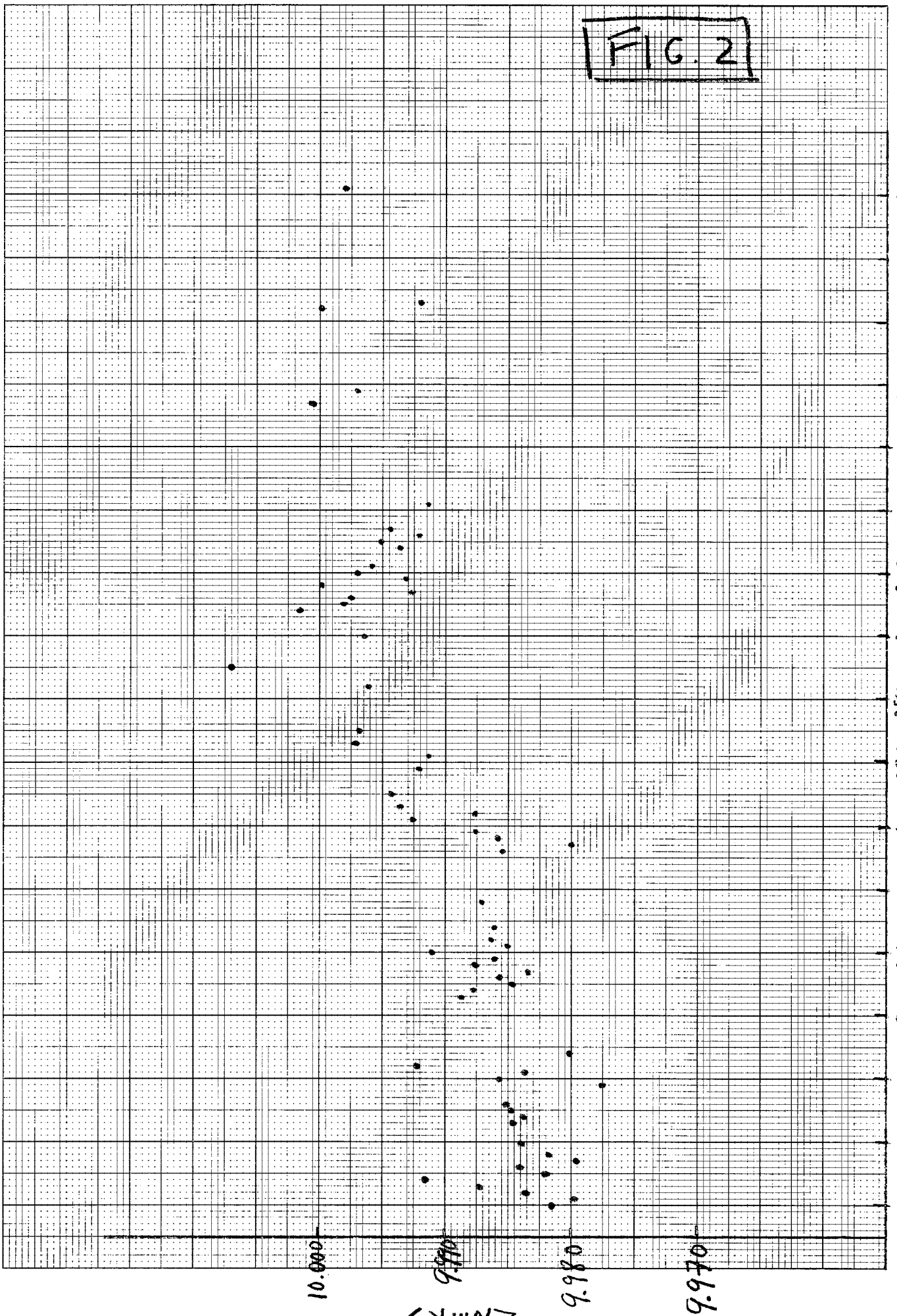

10.000
9.990
9.980
9.970
<NMR>
200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360
MAGNET NO.

FIG. 2

FIG. 3

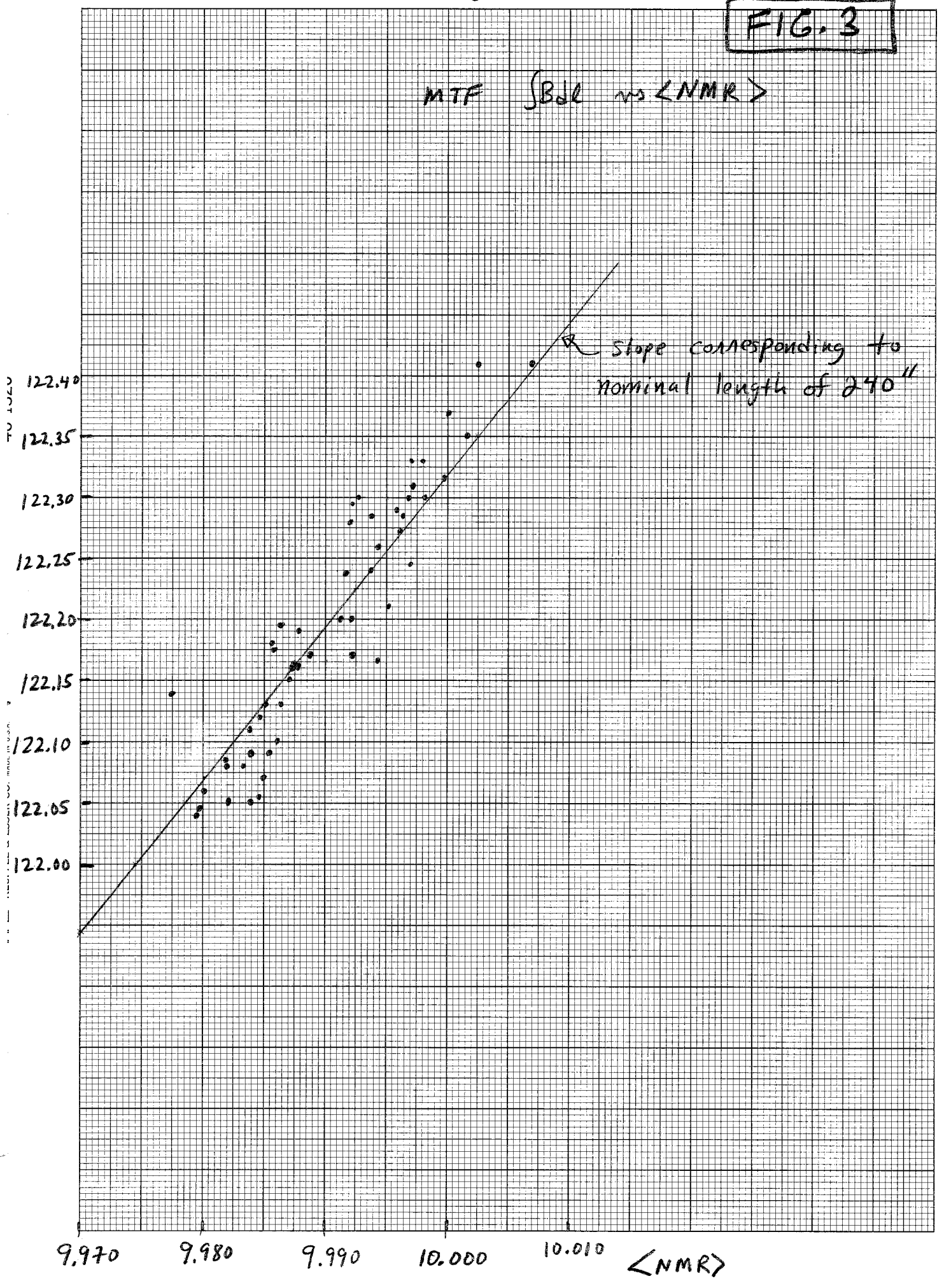

MTF ∫BdL vs <NMR>
Slope corresponding to nominal length of 240"
122.40
122.35
122.30
122.25
122.20
122.15
122.10
122.05
122.00
9.970
9.980
9.990
10.000
10.010
<NMR>

FIG. 4